

THE OPERATIVE TREATMENT OF OLD UNREDUCED AND IRREDUCIBLE DISLOCATIONS OF THE HIP.

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THE following recent case was sent to me by Dr. Campbell, of Livingston, Montana :

W. S., ranchman, aged thirty-three. On October 16, 1893, while threshing, he was struck on the left hip by an iron pulley, weighing about 350 pounds.

The injury was so severe that he was unable to use his leg, but he supposed it was only a severe sprain, and that it would recover. After walking around on crutches for about a month with no improvement he called a physician, who diagnosed a dorsal dislocation of the left hip. He was anaesthetized and reduction attempted, but without success. Four days after this a second attempt at reduction was made which was likewise unsuccessful. He then remained in bed two days when he was up and around on crutches again. Two weeks later a third attempt to effect a reduction was made, but with no better result than the previous efforts. He was unable to use the leg at all, and could only get around with the aid of crutches. Despairing of being able to effect reduction without operative measures he was sent to me at the Polyclinic, February 9, 1894. His leg presented the usual characteristics of a dorsal dislocation,—slight flexion, adduction, internal rotation, shortening, and the top of the trochanter major extending above Nélaton's line. The whole limb was somewhat atrophied, and both active and passive motion were very much limited and painful.

In view of the repeated and prolonged unsuccessful efforts at reduction it was concluded not to resort to forcible methods again, but to cut down upon the joint at once.

Consequently, on February 11, 1894, nearly four months after the injury, the following operation was performed :

An incision about fourteen centimetres in length was made in front of the great trochanter between the tensor vaginae femoris and the gluteus medius, thus leading directly down to the acetabulum and anterior surface of the head and neck of the femur. As was expected, the acetabulum was found filled with a tough, adherent connective-tissue proliferation from the anterior portion of the capsular ligament, which in falling over the cavity completely closed it. On cutting through the capsular ligament the head of the bone was found resting on the posterior and superior edge of the acetabulum in a shallow depression, the lining of which had a smooth cartilaginous feel. Immediately in front of the head and helping to fill the cotyloid cavity was a piece of bone, curved in shape, about three centimetres in length by one centimetre in depth and 0.5 centimetre in width, which had been detached from the posterior wall of the acetabulum. This may have been an obstacle to the early reduction of the case. The head of the bone was still covered with smooth cartilage, while the neck had acquired new firm adhesion to all the surrounding parts, thus producing a new capsular ligament. A restoration of the ligamentum teres could not be demonstrated, but a small portion of it was present in the depression in the head when the head was turned out of its new joint.

The adhesions to the neck were divided, and all the muscular attachments to the great trochanter and shaft as far down as the lesser trochanter were separated subperiosteally from the bone, thus liberating the entire upper end of the femur. Attention was then directed to the acetabulum, which, by means of the gouge and sharp spoon, was freed of capsular ligament and new connective-tissue formation.

The cartilage lining the bottom of the cavity was found to be still smooth. The head of the bone, however, could not be made to enter the acetabulum, which seemed too small. The cavity was consequently enlarged somewhat posteriorly with the gouge and mallet, after which, by considerable exertion and manipulation, the head was finally returned to its place, and the leg assumed its normal position.

The wound was partly stitched up, and the balance packed with iodoform gauze. The limb was placed in the extended position, slightly abducted and externally rotated, a plaster cast put on and extension applied.

The operation was a very severe one, occupying fully two hours. The patient suffered considerable shock, although the loss of blood was not great. Reaction came on promptly, and the progress of the case was favorable from the start. There was considerable serous drainage from the wound during the first few days necessitating rather frequent renewals of the dressings.

In three weeks the wound was closed, but in another week, on March 6, there was a rise in temperature, with pain over the great trochanter. Upon opening one corner of the wound a small quantity of sero-pus was evacuated from a small cavity superficially situated over the trochanter, and not communicating with the joint. A counter-opening posteriorly drained this, and it gave no further trouble.

The extension was continued three weeks. After its removal the leg swelled considerably throughout its entire length. This was relieved by tight bandaging, so that in about two weeks more, or six weeks from the time of the operation, he was allowed up on crutches. In three months he could walk with a cane without pain in the hip. There was active motion in all directions,—flexion, abduction, adduction, and rotation, which, though limited, was daily increasing.

The marked deformity, permanent disability, and often great suffering, resulting from old unreduced dislocations of the hip have led surgeons of all times to resort to extreme measures to effect a reduction. The older methods, of the application of great force after manipulation failed, were often followed by serious results, and frequently failed altogether.

On the advent of antiseptic surgery it was hoped these cases might be remedied by operative measures. How this hope has been realized a short review of the literature on the subject will determine. The first one to resort to operative measures to effect a reduction of an old unreduced dislocation of the hip was Delagarde,¹ in 1861.

CASE I.—Robert H., laborer, aged fifty-one years. Five months before the operation had the left lower extremity crushed and lacerated by the falling of a cob wall.

¹ St. Bartholomew's Hospital Reports, 1866, Vol. II, p. 183.

The thigh bone was broken in two places and its head dislocated into the sacro-sciatic notch. On August 1, 1861, four months after the accident, he was brought to the hospital. The fracture was well united, but no attempt had been made to reduce the dislocation. The man's state was deplorable. The slightest attempt to move the thigh made the head of the femur press on the sciatic nerve, producing throughout the limb a most peculiar numbness which was intolerable.

He lay as straight as if a spit had been thrust from his heel to his head. His health was rapidly sinking. The head of the femur was lodged deeply in the upper part of the notch, and the neck lay buried in the soft parts. September 1, 1861, Delagarde made a deep incision from the trochanter to the sacrum through the glutæus, and laid bare the neck and head of the femur. Upon this an adventitious capsule had been formed. The ligamentum teres was strained but not broken. The pyriformis tendon passed under the neck with the obturator tendons. The limb was rolled inward and an elevator carefully pressed under the neck of the femur so as to lift the head off from the sciatic nerve.

The semilunar limb of a very strong bone-cutter was passed under the neck near the trochanter, but the bone was so hard that not the slightest impression could be made. It was withdrawn and a trephine tried. The pivot could hardly be made to pierce the bone, but at length with great labor a circular disk was taken out. The cancellated structure was gouged out until the opposite wall was reached, then a smaller trephine was introduced and worked nearly through the bone. Then a strong narrow-bladed saw was passed into the cavity, and the bone remaining between the two circles was divided by it. A very strong pair of bone forceps was fixed first in one groove and then in the other until the head of the bone was thus cut off. The splintered portions were nipped or filed down. The sciatic nerve was laid bare for an inch and a half. It was curiously flattened and moulded to the head of the femur. The operation took three-quarters of an hour. Relief was immediate. The wound healed in six weeks. He could sit up in bed with the thigh at a right angle with the body. Gentle exercises on the parallel bars soon gave great freedom of motion. He was discharged on January 16, 1862, with a serviceable limb and in good health.

He died in the summer of 1864, of pneumonia, having slept in the rain one Saturday night instead of going home as a sober man would.

CASE II (Hamilton¹).—Male, twenty-eight years old, was thrown while wrestling. A surgeon, who was called in the next day, finding a dorsal dislocation, placed him under an anaesthetic, and, as he supposed, reduced the dislocation by manipulation.

It was not reduced, however, and, although this fact was recognized, no further attempts at reduction were made until the case was sent to Dr. Hamilton.

January 29, 1869, some seven months after the accident, Dr. Hamilton attempted to break up the adhesions and reduce the dislocation, the patient being under the influence of ether, but after a trial of nearly an hour the attempt was abandoned.

February 24, he was again placed under the influence of ether and another attempt made to reduce it, but without success. Believing now that the un torn portion of the capsule and particularly the ilio-femoral ligament constituted the chief obstacle to reduction, a long, firm but narrow bistoury was introduced just above the trochanter major, carrying its point inward until it touched the neck at the base of the trochanter. From this point, the edge of the knife being directed towards the head of the bone, the point of the knife was swept slowly along until the head was distinctly felt.

This was accomplished without enlarging the external opening. While the incision was being made, the limb was kept rotated outward and abducted as much as was possible, and it was felt to yield distinctly, so that both rotation outward and abduction were more complete afterwards than before. The tensor vaginæ femoris was then divided and attempts at reduction were repeated both by manipulation and extension, but without success. The subsequent history of the patient is not given.

CASE III (Volkmann,² May, 1876).—W. H., laborer, fifty-one years old. On February 5, 1876, while working in a clay ditch, he was almost buried under a large mass of earth from the caving in of the bank. After being liberated he was unable to work and was taken home. He remained in bed four weeks, when he undertook to go around on crutches. He had no medical treatment. After two months, no improvement taking place, he came to Volkmann's clinic. He was unable to walk a step without crutches. An examination showed that rare form of dislocation of the hip described as *luxatio perinealis*.

¹ Hamilton, Fractures and Dislocations, 1880 ed., p. 799.

² Berliner klinische Wochensch., 1877, p. 357, by H. R. Ranke.

On April 2 attempts at reduction were made under deep narcosis. The attempts were not successful in so far as reducing the head was concerned, but succeeded in converting it into an ordinary dorsal dislocation. Repeated attempts to bring the head from this position into the acetabulum only succeeded in placing it back in the old position in the perineum and again on the dorsum ilii.

Six or eight times was the head passed from one position to the other, and, as reduction was impossible, it was finally left in the dorsal position, as it was thought to be more accessible to operative procedure in this position than in the perineum.

An extension dressing was applied, and kept up with considerable weight for six weeks, in the hope of getting a better position and a more useful limb. However, this hope failed completely.

May 15, 1876, or about three and a half months after the accident, the soft parts were divided by a long, straight incision over the great trochanter as for an ordinary resection. As the head lay flat upon the dorsum ilii it was not sufficiently exposed by the longitudinal incision, so a transverse cut of about eight centimetres through the glutæus maximus, but not involving the skin, was added to it.

Although the head and neck could now be easily seen, the hindrances to reduction could not be discovered. The muscles attached to the great trochanter were now separated in the usual manner, but this also led to no results. The head still remained immovable and, in spite of repeated attempts, could not be reduced. The capsule as such was not recognizable, but the whole surrounding of the joint was indurated.

At last the head was freed so that upon strongly adducting the thigh it was brought out of the wound. Now for the first time could be seen a thick muscular layer stretched over the acetabulum. Its upper layers were indurated and fibrous and everywhere grown to the edge of the cavity. It was at least one centimetre thick. Every attempt, therefore, to bring the head into the acetabulum had to be given up and the head immediately resected.

It was consequently drawn out of the wound and removed with the usual amputating saw below the trochanter and the end rounded off with a bone forceps. A light pull on the foot now succeeded in bringing the leg into its normal position. The usual extension dressing for a resection was applied and the healing was without special incident.

July 5, with a Wolf-Taylor's apparatus, the first attempt at

walking was made, and in eleven days more he was allowed to go home.

Result Nine Months after the Operation.—The right foot is scarcely smaller than the well one. When the pelvis is straight there is a shortening of four centimetres. Passive motion without narcosis is not very extensive, active motion about the same. He walks without a high shoe, with the aid of a cane, and has a moderate limp. Extension is still continued at night.

CASE IV (MacCormac,¹ 1878).—A sailor, some twenty months previous, received a thyroid dislocation of the hip. All other means of reduction having failed, MacCormac tried subcutaneous tenotomy of the obstructing muscles, but without any benefit, as reduction was still impossible. He then made a resection of the head of the bone through a large Y shaped incision over the trochanter. The result of the operation is simply stated as being good.

CASE V (Sidney Jones,² 1879).—A. R., eleven years of age, in May, 1879, met with an accident producing a dorsal dislocation of the right hip. The dislocation was recognized, and is said to have been reduced and splints applied, but when these were removed the head of the femur was still found on the dorsum ilii. Several attempts at reduction were made, but without success.

The patient came under Mr. Jones's care in October, 1879. Three attempts by manipulation and pulleys were made, but to no purpose. The limb was useless for progression on account of the shortening and inversion. November 25, 1879, seven months after the accident, the head of the bone was excised, the malposition of the limb corrected, and the upper end of the shaft drawn down to the acetabulum, which was filled up with condensed tissue and inflammatory material.

Five years after the operation the boy had a straight limb, one inch shorter than the opposite one. He can run, jump, play cricket, and ride a tricycle.

CASE VI (Koch³).—J. S., forty-one years old, strong farmer, was injured in the early part of 1880 by a falling tree, causing a dislocation of the right hip.

Attempts at reduction were made some days later, but without

¹ St. Thomas's Hospital Reports, 1878, Vol. ix, p. 101.

² London Lancet, November 15, 1884.

³ Berliner klin. Woch., 1882, p. 492.

success. October 1, 1881, twenty months after the accident, he came to the Dorpat clinic.

The head of the thigh bone had the characteristic position of a sciatic dislocation, and was probably separated from the shaft by a fracture of the anatomical neck.

However, the fractured surfaces must have been held in close contact by short fibrous tissue as the crepitus between the ends of the bone, which were demonstrably movable, was only very slight. The tip of the trochanter was one and one-half inches above Nélaton's line. With the pelvis straight the leg was flexed 90° , strongly rotated inward and abducted 45° .

Attempts to move the head back into the acetabulum were without effect.

October 3, 1881, osteotomy just above the lower trochanter was performed, a wedge of bone being taken out posteriorly. October 17, wound healed.

In deep chloroform narcosis the shaft was fractured from the trochanter by torsion. The extremity was then placed in extension, abduction, and external rotation, and fixed in plaster with the other thigh and pelvis. November 7, the fracture was consolidated, but the patient could not walk on account of swelling of the limb. By the end of December recovery was complete.

When lying in a horizontal position the leg was abducted about 40° . Flexion and external rotation were such as to bring the foot in the same position as the left leg. The ankle is ankylosed at 145° , and there are seventy-five centimetres shortening. The abduction of 40° was attributed to the fact that the patient would not lie straight in bed. This position could be corrected by another osteotomy or fracture of the femur.

By marked flexion and bending of the pelvis he could just bring the ends of the metatarsal bones to bear on the ground and walk. Walking, however, was difficult.

CASE VII (Wahl,¹ February 16, 1882).—A case of dorsal dislocation of the left hip, which was irreducible at the end of only twenty-five days.

February 16, 1882, Wahl chiselled the bone below the great trochanter, broke the shaft, and placed the limb in a straight position at the same sitting. He secured such a perfect union of the wound

¹ Berliner klin. Wochen., 1882, p. 492.

that on the 10th of March, with a plaster cast on, the first attempts at walking were made, and on the 18th of March he was discharged with a straight and useful limb. There were a few centimetres of shortening.

CASE VIII (William Adams,¹ March 29, 1882).—A boy, eleven years old, during an attack of rheumatic fever, suffered a dislocation of the head of the femur on the dorsum ilii.

The patient was admitted to the Great Northern Hospital, under Mr. Adam's care, March 4, 1882.

All attempts at reduction were unsuccessful even after a subcutaneous division of the adductor longus tendon. Mr. Adams then excised the head of the femur by making a T-shaped incision with the long arm two and a half inches in length directly over the head and neck, and the short arm one inch in length transversely over the head, which was at once exposed. The head of the femur was uncovered by capsular ligament and the articular cartilage was in a healthy condition.

It was found that the capsular ligament had been ruptured and the torn margins of the rent passed on either side closely embracing the neck of the bone.

After dividing the margins of the capsular ligament the operator passed his small subcutaneous saw to the neck of the bone and cut through it a little below the margin of the articular cartilage. The detached head was then drawn out of its position after some slight adhesions were cut through.

The round ligament preserved its normal connection with the head of the bone and was adherent to the articular cartilage, having been divided with the saw a little below the head.

The wound progressed favorably without much suppuration, and on June 1 was completely healed. June 14 the patient was allowed to walk with crutches, and on October 1, without them.

The limb was perfectly straight and motion at the hip-joint free in all directions.

CASE IX (Polaillon,² 1883).—This was a case of obturator dislocation, of one and a half months standing, in a man forty-six years of age.

The dislocation being forward, the incision was made anteriorly.

¹ London Lancet, November 1, 1884.

² Bull. et Mém. de la Soc. de Chir., January 31, 1883, p. 110.

No regard for the muscles was shown, but all tight bands which offered resistance were divided, which included all muscles attached to the great trochanter. The head and neck of the bone were completely isolated from the soft parts. Reduction of the head was finally accomplished, and in this respect the case was successful, but the patient died very soon after from foudroyant gangrene. This is the first case wherein reduction by the open method was effected. At the autopsy the great trochanter was found nearly detached from the femur.

CASE X (Marguary, 1884¹).—This was a case of dorsal dislocation irreducible after eight months. An attempt was made to reduce by the open method, but had to be abandoned, and resection of the head of the bone was performed. The result is stated as having been good. Further details of this case were not accessible to me.

CASE XI (Nicoladoni, 1886²).—This was a case of dorsal dislocation of seventy-six days standing. The usual incision for resection was made, and after an unsuccessful attempt to reduce resection was completed, the bone being divided below the great trochanter. The case suppurated and the result is not stated.

CASE XII (Severano, October, 1886³).—A peasant woman, while working in a ditch, was suddenly buried by the caving in of the bank. She was taken out immediately but was unable to rise, and suffered pain in the right hip. Three days afterwards she was admitted to the service of Severano, and presented all the signs of an ischio-iliac dislocation. After unsuccessful attempts at reduction under chloroform by manipulation a traction apparatus was applied, but in spite of traction, to the extent of 400 kilogrammes, it was impossible to displace the head of the femur more than a few centimetres. At the same time traction was being made pressure was exercised upon the head from above downward and behind forward. After three-quarters of an hour of unsuccessful efforts Severano made an incision, ten centimetres in length, over the head of the bone and parallel to the fibres of the glutæus maximus. On introducing his finger into the wound to explore the surroundings of the neck, in order to discover the cause of the irreducibility, he found that the capsule was torn at its inferior part, and that the limb when rotated inward, thus displacing the head upward and backward, had so twisted the capsule upon its axis that the head could not be returned through the opening made on leaving the

¹ Archivio di Ortopedio, January, 1884.

² Wien. med. Wochensch., 1885, No. 23, p. 729.

³ Cong. Franç. de Chir., 1886, 2d Sec.

cavity. With the aid of a blunt-pointed bistoury a large incision in the capsule was made.

Traction was again applied and carried to the extent of 400 kilogrammes. A less resistance was found, nevertheless, it was impossible to obtain an elongation of more than about two centimetres in order to make the head regain its cavity. In the face of these repeated unsuccessful attempts at reduction resection of the head of the femur was practised, after which the neck entered the cotyloid cavity and the limb assumed its normal position. The wound was then cleaned, drained, and sutured, an aseptic dressing applied, and the limb fixed in plaster of Paris. After thirty days' treatment the wound healed without accident.

The patient then left the hospital clandestinely, and nothing is known of his after history.

CASES XIII and XIV (Vecelli,¹ 1887).—The first of these cases was a dorsal dislocation in which a free anterior incision with division of tendons was made, and the second an anterior dislocation. Reduction is said to have been accomplished in both cases; but details are lacking, and the ultimate result is not known.

CASE XV (Quénu,² September 28, 1887).—B. B., aged twenty-six years, stone-cutter by trade, was thrown down July 10, 1887, by an enormous block that he was trying to displace. He was immediately carried to the hospital, and the next day the surgeon found the usual signs of a dorsal dislocation of the right hip. Chloroform was given and an unsuccessful attempt made at reduction. Some days after the patient was again put to sleep, and for an hour attempts were made to bring the head of the femur into the acetabulum by the use of force and traction apparatus, but all efforts were ineffectual. The days following these efforts the patient had fever and complained of pain in the whole limb, while the region affected presented some swelling. On August 12, one month after the injury, he was still obliged to remain almost continually in bed. He had tried to walk on crutches, but had to give them up on account of pain. He could only sit on the left side, and even when in bed often complained of pain along the sciatic nerve, which was increased immensely upon the slightest movement. The attitude of the limb was one of adduction, flexion, and internal rotation. Shortening six centimetres.

¹ Fiorani, Comptes-Rendu dans l'Archivio di Ortopedio, 1887, Anno IV, p. 411.
(See Bloch.)

² Rev. de Chir., 1887, No. 7, p. 1003.

August 17 another attempt under chloroform was made at reduction, but in spite of a probable tearing of the ligaments, as indicated by crackling sounds, the head could not be moved from its place. Considerable pain followed this attempt. He was put to bed, and during the next month some amelioration in the functional state of the limb was hoped for, but no progress was made, so an operation was proposed to the patient and accepted. The hope was still entertained that after opening the joint the cause of the irreducibility could be discovered and removed, and the head replaced in the acetabulum.

September 28 an incision about fifteen centimetres long was made posterior to the great trochanter over the head of the femur. After section of the glutæus maximus, which was very thick, a veritable capsule masking the head was encountered. It was necessary, in order to uncover this, to cut through a thick vascular layer extending from the coxal bone to the neck of the femur.

After several incisions, made difficult on account of haemorrhage at the bottom of a deep wound, it was found that not only new ligamentous tissue completely covered the bone, but that all around the head this new capsule contained irregular plaques of cartilaginous consistence, simulating a new articular cavity. The sciatic nerve, which was raised and pushed upward and backward, was drawn aside, and search was made with the finger to discover the breach in the capsule produced at the time of the dislocation, but in front as well as behind the capsule was complete and very thick. There was no sign whatever of an acetabulum. After section of a part of the anterior capsule, an attempt at reduction was made in the hope of mobilizing the head and the better to find the acetabulum, but the head remained immovable, and pressed strongly against the ilium. Thinking that the wound by this time, from so much manipulation, had become contaminated so as to interfere with union, and lead to the formation of an abscess, it was decided to remove the head of the bone, which was done with a chisel and mallet. It then alone became possible to correct the vicious position of the limb, and to place it in extension and external rotation. The wound was closed with drainage, but suppuration occurring it was reopened and packed with iodoform gauze. An abscess formed in front of the trochanter about the head of the bone, which was opened and drained. Recovery was slow. Extension was kept up for more than four weeks.

November 15, forty-eight days after the operation, the patient

was permitted to get up on crutches. The limb was straight and in excellent position, with four centimetres shortening.

By the end of February, five months after the operation, he could walk with the aid of a cane. There was some motion in the hip, and he could flex the knee to a right angle. He had no more pain such as he had before the operation. He was advised to wear a shoe with a thick sole.

CASE XVI (Oscar Bloch,¹ December 23, 1887).—N. L., aged seventeen years, apprenticed carpenter, arrived at the Frederick Hospital, December 6, 1887. One hundred and three days previously he met with an accident during a *fête*. After the accident he was transported to the Province Hospital, situated in the neighborhood. There a physician diagnosed a dorsal dislocation of the hip, and attempted its reduction under anaesthesia. The patient awoke during the manipulation and heard a noise, which was also perceived by his father, and which was supposed to have been caused by the head slipping back into place. At the end of seventeen days he left the bed, and, upon the consent of the physician, left the hospital, his left extremity being in a bad state as to mobility.

Four or five weeks later the physician found the patient had pain on walking due to the dislocation, which had never been reduced. He was then sent to the Frederick Hospital, under Dr. Bloch's care. On December 9, an ineffectual attempt at reduction was made under anaesthesia, which was repeated on the 15th, with the same result.

December 23, 120 days after the accident, the following operation was undertaken: An anterior exploratory incision was made between the sartorius and rectus muscles. On alternately flexing and extending the femur the capsular ligament was recognized with difficulty by touch. However, by the aid of retractors, he succeeded in uncovering the anterior face of the capsule for a distance of about five centimetres, which he freed to an extent of three centimetres. On introducing the finger the tight bands could be felt but not seen. He cut particularly upward, outward, and backward, then tried twice to reduce the head by flexion followed by rotation inward, adduction and traction upward, then rotation outward, but without success. He could then feel clearly that the acetabulum was filled with solid matter. The wound was irrigated with carbolized water, cauterized with

¹ Rev. d'Orthop., May 1, 1890.

10 per cent. zinc chloride, irrigated again and sutured with catgut, leaving a place for drainage. Langenbeck's incision for resection was then made. The head was found enveloped in a soft ligamentous capsule. It was raised up with two of Langenbeck's sharp hooks and detached with difficulty. The acetabulum was completely filled with fibrous masses, of which a small cuneiform portion was taken out to form a slight depression and a fresh surface. The limb was placed in a normal position, and dressed with extension, which was continued for eight weeks. Both wounds healed *per primam*, and in fifty-seven days after the operation he left the hospital. Eleven months after he was in good health, and able to work at his trade of carpentering. The reare three to four centimetres shortening, he has some motion at the hip-joint, and can walk without a cane, although he needs one for long distances.

CASE XVII (C. T. Parkes,¹ May 12, 1888).—G. S., twenty-one years old, applied for treatment of an old upward and backward dislocation of the hip of one year's standing, caused by a bank of coal falling on him while in a stooping position. The patient limped severely and suffered great pain on walking. The diagnosis made was readily confirmed. The patient being somewhat emaciated, the head of the bone could easily be felt on the dorsum ilii, and the limb had the characteristic position accompanying this form of dislocation. He was anaesthetized and reduction attempted by means of manipulation. All methods having been tried and found useless he was permitted to rest for a week, when a second attempt was made. This time extension and counter-extension by means of the compound pulley was made use of, together with manipulation, but again with a negative result. Several fruitless attempts had been made shortly after the injury by different surgeons. An incision eight inches long was now made directly over the head and great trochanter as low down as the lesser trochanter and through the new connective tissue down to the ilium. The muscles were separated from the great trochanter so that all restricting tissues were divided. The wound was held open by means of sharp hooks laying bare the acetabulum, which was found empty and in a normal condition, except a slender patch of the upper margin which had been broken off. Only the lower part of the capsule could be distinguished, and this was attached to the neck of the femur and the brim of the acetabulum. Placing

¹ N. A. Practitioner, November, 1890, p. 499.

the handle of an open forceps in the acetabulum the head was readily pried into place, and retained there by means of extension, which was continued eight weeks. The wound was closed by deep silk sutures and a rubber drainage-tube inserted. Healing by first intention occurred except along the track of the tube. At the end of eleven weeks the patient was discharged from the hospital, able to walk with a cane and a crutch without pain. The position was very good, and the range of motion limited, but constantly increasing. His after history is unknown.

CASE XVIII (Ricard,¹ August 2, 1889).—Adult, male, fell from a high place, dislocating his right hip. Several attempts were made during the first few weeks following the accident to reduce it, but without success.

When Ricard saw the patient, eight months after the injury, he presented the symptoms of an ischiatic dislocation. Walking without the aid of crutches is impossible, and the mobility of the head of the femur is such that the limb cannot furnish to the trunk a point of support. Walking, prolonged standing, and the sitting position provoked severe pain, so the patient earnestly asked for surgical intervention. Consequently Ricard operated as follows: He uncovered the head of the femur by a posterior incision placed over the prominence formed by the dislocated head, resected the femoral sphere, separated with a rugine the capsule adherent to the acetabulum, and after having mobilized and pushed in front this capsule, enlarged with a gouge and mallet the deformed acetabulum. This done he placed in the reconstructed cavity the stump of the femoral neck. Cicatrization was rapid and a new joint formed owing to the movements communicated to the thigh at the end of six weeks. The patient stayed in bed until October 6, walked with crutches until October 29, then, with the aid of a cane, left the hospital eighty-eight days after the operation.

Some months later he presented the following condition: The thigh was straight, but still a little atrophied. A new joint had become established between the neck and acetabulum, and the crepitus, which was clearly perceived on motion of the hip, demonstrated the contact of two bony surfaces. This new joint was solid, and the patient standing on the well limb could execute movements of flexion, adduction, and slight abduction. There were four centimetres shortening.

¹ Bull. de la Soc. de Chir., November, 1890 (Reports by Nélaton), and Le Mercredi Méd., November 26, 1890, p. 587.

CASE XIX (C. T. Parkes,¹ June 6, 1890).—F. G., thirty years old; American; farmer; applied for treatment of a backward dislocation of the right hip of five months standing, giving the following history:

January 3, 1890, while handling sacks of wheat in a mill, a sack weighing 120 pounds fell a distance of twelve feet, striking him on the hip. He was in a bent-over position in the act of picking up another sack. He was thrown to the ground and a tier of sacks rolled over him. The physician called diagnosed a backward dislocation. The patient was anaesthetized and the dislocation reduced according to the judgment of those present, after manipulation lasting one and one-half hours. Splints were applied and left in position four weeks. Two weeks later the patient noticed that the joint was not normal, and at the end of five months his doctor found that an unreduced dislocation still existed, and sent him to Dr. Parkes. Upon arrival the patient walked with a severe limp, suffering much pain at every step. The head of the bone was felt in the ischiatic notch and the other signs of a backward dislocation were present. Two attempts were now made at reduction under anaesthesia, the first by means of manipulation, the second by means of manipulation and extension with the use of the compound pulley, but reduction was impossible. Notwithstanding the fact that much force was applied the head did not move in the least. Four days after the second attempt an incision nine inches in length was made over the joint in the ischiatic fossa, a portion of the cartilage covering it having been loosened, probably by the forcible manipulations. It was very difficult to find the acetabulum, because it was covered with new connective tissue and the muscles of the anterior surface of the thigh were drawn tightly over it.

A transverse incision four inches long, extending forward from the middle of the original incision, was made to expose the parts. Having freely cut those tissues remaining close to the bone, the muscles were cut, exposing the acetabulum, which was found in a normal condition. There was a thin plate of bone found in the connective tissue surrounding the head. Placing the handle of an instrument in the acetabulum the head was replaced, but only after much manipulation and the application of much force. It was retained in position by means of extension, which was continued for ten weeks. The

¹ N. A. Practitioner, November, 1890, p. 499.

wound was closed by deep and superficial catgut sutures and two rubber drains applied. The patient showed a considerable amount of shock, but rallied nicely. The wound healed well, but became somewhat infected by being accidentally covered with faeces on the fifth day during an evacuation of the bowels with the aid of an enema. The patient was discharged fourteen weeks after the operation, being able to walk without crutches, though he still used them for safety. The position of the limb was normal, and the motion of the joint very fair and constantly improving. The successful reduction was accomplished only after a free separation of all the muscles attached to the great trochanter and upper portion of the shaft by means of the knife, and principally by the use of the raspatory.

CASE XX (Villeneuve,¹ December 1, 1890).—Man, aged forty-eight years, entered Hôtel Dieu, November 18, 1890. Fifty days previous he had received a dislocation of the left hip. There was so much swelling and ecchymosis at the time that the physician in attendance was not able to demonstrate the dislocation until after fifteen days. Then two attempts at reduction without anaesthesia failed. Upon entering the hospital a subpubic dislocation was easily diagnosed. Walking without crutches was entirely impossible, and difficult and painful even with them.

November 20, fifty-two days after the accident, attempts at reduction under chloroform with the aid of pulleys, traction, and manipulation for an hour were unsuccessful. He was then put to bed for some days, when it was resolved to make another attempt at reduction under chloroform, which, if not successful, was to be followed by arthrotomy.

Accordingly, on December 1, the patient was put to sleep, when, reduction continuing impossible, a vertical incision was made on the anterior surface of the thigh to one side of the anterior inferior iliac spine. The muscles were divided until a resistant fibrous plane was reached, which was likewise divided layer by layer. Thus was formed a contractile opening through which the finger felt the base of the neck of the femur and the anterior semicircumference of the head. In order to facilitate the manœuvres the incision was enlarged to twenty centimetres. Through this large opening one could feel and even encircle the neck. The manœuvres of reduction were repeated, but always without success. With difficulty a crotchet was passed

¹ Rev. d'Orthop., May, 1892, p. 161.

around the neck of the femur, and by making traction on this while the limb was placed in flexion, adduction, and internal rotation, many efforts were made to replace the head in the cotyloid cavity, but without success. It was, moreover, impossible to feel the cotyloid cavity which was separated from the finger by a thick layer. It was necessary, in order to insure its integrity, to make another incision farther out, but it appeared preferable, in order not to prolong an operation already long and laborious, to practise osteotomy. The external lip of the wound was drawn strongly outward, while with a large Macewen chisel the trochanter was divided through its inferior third. The member was then easily placed in a straight normal position, a dressing applied, and the limb placed in a Bonnet's splint. The operation lasted nearly two hours. The recovery was aseptic and without notable incident.

The patient left the hospital on March 1, 1891. The limb was in a normal direction with a slight flexion upon the pelvis. There were about four centimetres shortening. Flexion at the hip was limited, so that when he wished to sit down he did it by leaning on the right side and stretching out the operated limb. He could dress himself without assistance, except putting on his stockings. Fifteen months after the operation he walked with the aid of a cane, limped after walking fifteen minutes, and after walking much had pain in the anterior region of the thigh.

CASE XXI (Hughes,¹ December 5, 1890).—T. B., an eleven-year-old boy, was admitted to the hospital September 20, 1890. He stated he was running behind and pushing a swinging boat when he slipped under it. On its return the boat struck his right knee, dislocating the hip.

He was seen by Mr. Hughes, who, with Mr. Lucy's assistance, attempted reduction under chloroform. This failing, he was brought to the hospital for a farther attempt with the pulleys. On admission there was a contusion over the front of the right knee, and the right leg was everted, abducted, and shortened to an extent of two and a half or three inches. The head of the bone could be seen and felt lying half-way between the umbilicus and Poupart's ligament. Both trochanters could be easily felt on rotating the limb. There was considerable effusion of blood into the soft tissue around the joint. The femoral artery could be felt pulsating on the inside of the lesser

¹ London Lancet, January 23, 1892, p. 194.

trochanter. Methylene was given and reduction again attempted by means of pulleys and manipulation. The head of the bone could not be got below the pelvic brim by any means. He was then put to bed with extension. In a few days there was widespread ecchymosis over the lower half of the abdomen, perineum, and right thigh. While awaiting absorption of the effusion he developed an attack of acute rheumatism which delayed the operation until December 5, when methylene was given and an incision four inches long made over the neck of the femur. The head was exposed, and all the ligamentous and muscular attachments to the neck and great trochanter were divided. Traction was then applied without effect. The tip of the great trochanter was found to be separated and a large amount of periosteum stripped from the back of the femur. At the back of the femur connecting the shaft with the back of the acetabulum was an elongated mass of bone formed by the periosteum which was stripped from the back of the femur. The neck was sawed through and the head removed. Traction was again applied without result. The wound was then closed. Six weeks later, when he got up, there were two inches shortening.

In July, seven months after the operation, he was able to walk well with a high boot. The hip was quite stiff and two inches shortening present. The cause of the irreducibility was never determined.

CASE XXII (Helferich,¹ May 19, 1891).—A four-year-old girl, fourteen days before, while walking, fell. She could not arise herself, and had to be carried home. She complained of pain in the left hip and thigh. A physician ordered a salve to be rubbed in, but not improving she was brought to the clinic May 14, 1891, the thigh was slightly flexed, adducted, and rotated inward. Shortening from anterior superior iliac spine to patella four centimetres, great trochanter three centimetres above Nélaton's line. Diagnosis, dorsal dislocation. Under anæsthesia reduction was impossible.

May 18, an incision seven to eight centimetres in length was made a finger's breadth external to the anterior superior iliac spine, extending downward in the direction of the limb between the posterior border of the sartorius and the tensor vaginæ femoris muscles. By a blunt dissection the acetabulum, which was normal and empty, was laid bare. External to the acetabulum the head could be felt, though

¹ Deutsche med. Wochensch., August 10, 1893, p. 761.

not yet free, as the capsular ligament intervened, the tear in it having already healed. By retracting the wound with Langenbeck's retractors, the interposing soft parts—that is, the capsule, extending from and covering the head and neck of the femur—were divided. By moving the thigh the opening in the capsule enlarged so that the intact cartilaginous covering of the head could be felt, and reposition accomplished. This occurred by drawing outward and at the same time rotating outward the leg. All movements were now free, but luxation easily recurred upon adduction, therefore after closing the wound the limb was fixed in abduction. The progress was favorable; highest temperature 38° C. on the evening of the operation, after which it was normal.

May 25 the stitches were removed; June 1 the wound was healed, the splints removed, and passive motion began. In consequence of the first passive motion a slight joint irritation with a tendency to adduction appeared, which was corrected by putting on a little extension for a few days.

June 10 the patient could walk without support, and passive motion only in extreme excursion slightly hindered. After two years no abnormality could be detected.

CASE XXIII (Tillaux,¹ June 9, 1892).—Man, aged fifty years. Owing to a misstep he fell on his back and was run over by a wagon, which passed over the external part of the right hip near the middle. It produced there only a slight excoriation, but at once, owing to the traumatism, the limb assumed the position of a downward and forward dislocation. The dislocation was mistaken during the first few days, and no attempt at reduction made. At the end of eight weeks, the movements of the hip not returning, he went to Verdun to Dr. Lescuyer, who recognized the lesion, and took the case to Tillaux.

June 8 examination showed flexion sixty degrees with abduction and rotation outward so pronounced that only the external border of the femur and the knee rested on the bed when he was lying down. On palpation the head could be felt displaced markedly inward, internal to Scarpa's triangle under the adductor muscles, near the middle line from which it was separated by not more than a finger's breadth. Passive movements were very limited, and painful and active motion very difficult. After two unsuccessful attempts to

¹ Rev. d'Orthop., January, 1893, IV, p. 27.

reduce by force had been made, the following operation was done June 9:

An incision ten centimetres long was made parallel with and behind the tendon of the adductor magnus to the gluteo-crural fold. This incision conducted directly to the head, which was resected at its junction with the neck with mallet and chisel. After this extraction nothing was easier than to put the limb in its normal position, the neck itself passing into the acetabulum. The acetabulum presented relatively little alteration, and it was not necessary to touch it. The progress of the case was favorable. The leg was maintained in extension, combined with continuous traction, after the method of Tillaux. The apparatus was continued until the early part of August, completely immobilizing the leg until that time. The patient remained in bed during the month of August, but was able to move about. From the commencement of September he got up and walked with two crutches, and after a fortnight with two canes. He left the hospital at the end of September. At the time of departure there was no deformity apparent. It was necessary to examine very carefully to find perhaps a little flattening over the trochanteric region. Measurements showed no difference in the legs, either in length or circumference. He could execute all movements to a limited extent. Rotation normal, flexion to ninety degrees, abduction and adduction same as on the healthy side. Walked easily with a cane, but could do without it. When walking, nothing showed on inspection that an operation had been undergone.

CASE XXIV (Küster,¹ September 23, 1892).—On September 19, 1892, there came to the Marburger clinic a strong, nine-year-old boy who seven weeks previously had fallen from a tree. He could not get up on account of pain, and was carried to bed. The physician did not recognize the character of the injury, and simply ordered rest in bed for the first fourteen days. On attempting to walk a considerable shortening of the right leg was observed. The leg remained flexed somewhat and strongly adducted, and was very painful; however, the patient learned to walk a little with crutches, only the tip of the foot touching the ground. An examination showed a typical dorsal dislocation of the femur. The head of the bone on rotation was easily felt on the dorsum ilii, and the trochanter was two and a half inches above Nélaton's line. Active flexion and extension of the hip-joint

¹ Deutsche Zeitsch. f. Chir., Bd. xxxvii, p. 373.

to about 130 degrees was possible, but abduction and rotation were entirely impossible. Passive rotation to a slight extent was possible, though painful, while passive abduction was entirely lost. September 20 reduction under anaesthesia was attempted, but failed.

After being convinced of the impossibility of reduction, it was concluded, in consideration of the complete uselessness of the limb, its painfulness, and the youthful age of the patient, to attempt its reduction by operation, and in case of failure to reduce, resection was kept in view. September 23, under ether narcosis, Langenbeck's incision for hip-resection was made and the head and neck laid bare. The head lay in a complete, new-joint capsule from which upon incision clear synovial fluid escaped. The capsule consisted of thickened connective tissue, smooth within, and showed no bony growth. As free movements of the head were not yet possible, all the soft parts were separated from the trochanter as in a resection, all tight bands were divided, and so the head and neck cleared as far as the lesser trochanter. Upon attempting to raise up the head, the physicians were very much surprised to find the ligamentum teres somewhat thicker and shorter than normal, extending from its old insertion point in the head of the femur to the bottom of the new fibrous joint capsule. The otherwise completely movable head remained fast to this band after all other connections had been divided. This new-formed fibrous, vessel-containing band was divided, and only then could the head be raised out. The head was not deformed, nor worn away, and one could see where it had been lodged above and external to the border of the acetabulum. The acetabulum was entirely filled with a vascular connective tissue, and the cartilage so overgrown that no hole remained in which the head could be placed.

With a chisel and sharp spoon the acetabulum was excavated as in Hoffa's operation for congenital hip-dislocation. The joint cartilage was evidently destroyed, as upon deepening the cavity nothing was seen of it. After the cavity had been restored the head of the bone was returned to it without difficulty, although it showed a great tendency to redislocate itself upon motion, so the cavity was deepened a little more with a sharp spoon and made to correspond as nearly as possible with the shape of the head, then, after placing an absorbable bone drain, the soft parts were sewed over the reduced head with étage catgut sutures, thereby fixing it somewhat in place. The skin wound was sutured, extension with adhesive plaster on a T-splint applied, and the limb placed in an abducted position.

September 28, a small stitch abscess formed in the skin wound. These sutures were removed, while the étage stitches remained. The right limb was in a normal position and of the same length as the left one.

October 10, patient could sit up in bed straight without pain. Wound healed except a superficial line of granulations. October 13, by way of trial, the extension bandage was removed, but after flexion and adduction movements suddenly there again occurred adduction, rotation inward, and shortening, and the hip pained him. Evidently there was a tendency to recurrence. After easily reducing the head, the extension bandage was immediately reapplied and the limb placed in strong abduction. In order to insure the retention of the head in the acetabulum a second adhesive plaster was applied perpendicular to the trochanter major so as to press the head directly into the cavity. This strip passed transversely around the pelvis and over a roller in the middle of the side of the bed. A corresponding counter-extension to the other side prevented the sliding of the patient.

November 13, after one month of this threefold extension-dressing, he was again allowed to sit up. Flexion at the hip was now free and painless.

November 19, the extension dressings were removed, the limb was normal, and the head in the acetabulum with motion free.

November 24, the patient got up and made the first attempt at walking with a Volkmann's walking apparatus.

December 5 he was discharged, walking well with a cane and without pain.

August 5, nine months after the operation, the patient was again examined. He was on his feet the whole day without fatigue. He could walk hours at a time and run and jump without difficulty. The position and length of the limb were normal, and its muscles strong. Active and passive motion were as free and smooth and as extensive as in the other leg. The functional result was ideal.

CASE XXV (Gerster,¹ December 20, 1892).—M. W., eight years of age, was admitted to Mt. Sinai Hospital December 17, 1892. Seven weeks previously he had been run over by an express wagon, injuring his left hip. He had considerable pain at the time and had not been able to walk since. His condition had evidently not been recognized, for on admission there was marked inversion of the left leg, shorten-

¹ ANNALS OF SURGERY, May, 1893, p. 586.

ing of one and five-eighths inches, and the head of the femur could be plainly felt on the dorsum ilii. Previous treatment had consisted of a splint to the leg at the time of the accident and a plaster-of-Paris splint applied two days before admission. Manipulation of the thigh caused pain, and there was paralysis of the anterior tibial group of muscles.

December 20, under chloroform, reduction was attempted but failed. A longitudinal incision five inches long was then made with its centre corresponding to the great trochanter. Muscular tissues and capsule were incised nearly its entire length. The head of the femur was exposed, covered with a thin layer of granulation tissue. The base of the head was also covered with granulations and the acetabulum almost obliterated by them. A portion of the Y-ligament had to be cut away before the head could be brought by manipulation into the contracted acetabulum. The capsule was closed with catgut and the wound sutured, except at its centre, where iodoform gauze drainage was instituted. The limb was partially abducted and fully extended and an extension apparatus applied. But slight reaction followed the operation. On the ninth day the wound was dressed. It was clean and aseptic and there was no discharge. Three weeks after the operation the patient was out of bed. Passive abduction and external rotation were limited. Active flexion and extension were good, but rotation outward could not be accomplished. There were talipes equinus and inversion of the foot and an area of anesthesia over the whole dorsum of the foot. Over the anterior tibial group there was diminished faradic and galvanic reaction.

The patient received on alternate days galvanic and faradic currents, and left the hospital February 17, with a little improvement in the paralytic symptoms. The head of the bone remained in the acetabulum, and he was able to walk with the aid of a cane. On presenting the boy before the New York Surgical Society, March 8, 1892, two and a half weeks after he left the hospital, and two and a half months after the operation, it was found that dislocation had recurred since leaving the hospital. It seemed that the presence of the mass of granulations in the acetabulum, found at the time of the operation, and the subsequent atrophy and yielding of the capsular cicatrix, were important elements in explaining the recurrence of the dislocation, which, however, differed somewhat in degree from the original condition. The head was now occupying a position close to the margin of the acetabulum, but it was probable that the deviation

would be increased in the course of time. There was no traumatism to account for the displacement.

These cases, which comprise all the operations which have been performed for the relief of old unreduced dislocations of the hip that I have been able to gather from the literature at my command, may be divided into four classes,—

(1) Subcutaneous operations, division of the capsular ligament and contracted tendons, followed by attempts at reduction.

(2) Osteotomy of the shaft of the femur with correction of the position of the leg, the head of the bone being allowed to remain in its abnormal position.

(3) Resection (*a*) of the head alone; (*b*) of the head, neck, and trochanter major.

(4) Arthroscopy with reduction of the dislocation.

The first method we find to have been tried twice, Cases II and IV.

In Case II, a dorsal dislocation, the ilio-femoral ligament was divided subcutaneously, as well as the tensor vaginæ femoris muscle, but without the slightest benefit, as reduction remained impossible.

In Case IV, subcutaneous division of the obstructing muscles was likewise unsuccessful, and the head of the bone had to be resected.

That subcutaneous division of the capsular ligament, or the surrounding muscles, can be of no material aid in effecting a reduction will be readily understood when we come to consider the causes of the irreducibility.

The second method, or osteotomy, has been tried in three cases, Nos. VI, VII, and XX.

In Case VI the result was bad. There was still marked deformity, 40 degrees of abduction, an angularity was present at the upper end of the femur, and so much shortening existed that only the tips of the metatarsal bones could be made to touch the ground when standing, and walking was difficult.

Case VII is said to have had a straight and useful limb with a few centimetres shortening one month after the operation. Further details as to range of motion are not given.

In Case XX arthrotomy was performed with a view of effecting reduction, but after repeated unsuccessful attempts with the joint open, it had to be abandoned and the bone was divided through the lower third of the trochanter. The result cannot be called good as there were four centimetres shortening and motion was limited, so that when he wished to sit down he had to rest his weight on the right gluteal region while the left leg remained stretched out. After fifteen months he walked with the aid of a cane, and if he walked much he limped and had pain in the anterior region of the thigh. However, the result was an improvement on the patient's previous condition. Villeneuve (*loc. cit.*), the operator in this case, said, "I do not believe that a resection of the head would have given a result much superior, particularly if the cotyloid cavity had been found filled and effaced, as is possible and even probable, and if one had failed to excavate it with a chisel. I regard, nevertheless, that resection is the operation of choice, and should be made without delaying to attempt reduction, which is almost always impossible. But when from any reason resection is not practicable—and in the actual case it would have been without doubt very laborious—it is well to know that a straightening of the limb by osteotomy gives, on the whole, results very acceptable."

As osteotomy leaves the head in its abnormal position and consequently fails to relieve the severe pain which so frequently accompanies these old dislocations, likewise cannot improve the limited mobility which is always present, it cannot be considered in any way an operation of choice.

As belonging to the third class we find thirteen operations (Nos. I, III, IV, V, VIII, X, XII, XV, XVI, XVIII, XXI, and XXIII), in ten of which the head alone was resected, in two the head, neck, and trochanter were removed, and in one the amount removed is not stated. In the majority of these cases the operator started out, not with the idea of doing a resection, but with the view of effecting reduction by arthrotomy, and only after repeated unsuccessful efforts to restore the head to the acetabulum was resection decided upon, as offering the only means of bringing the limb into a straight and useful position.

That so many good operators should fail to effect reduction, even after the joint is freely opened, makes it necessary to inquire into the causes of this persistent irreducibility.

In the first place, we find that the rent in the capsular ligament through which the head of the bone escaped, closes quite early. Thus in Case VIII, of something over a month's standing, the rent had closed tightly about the neck of the bone, and in Case XXII, of only eighteen days' standing, the tear in the capsular ligament was found already healed. It is very evident that after this rent has closed, the head of the bone cannot be made to enter the acetabulum without again tearing an opening in this ligament. Then in nearly all the cases of any standing the acetabulum is described as being filled or covered up. The unturned portion of the capsular ligament falls over and acquires attachments to the border of the cavity, which is gradually filled with new connective-tissue proliferation. Thus in those cases where the state of the acetabulum is mentioned we find it stated in Case V, of seven months' standing, as being "filled up with condensed cellular tissue and inflammatory material;" Case XV, of two and a half months, "no sign whatever of the acetabulum." Case XVI, of 120 days, "acetabulum was filled with solid matter;" Case XVIII, of eight months, "acetabulum deformed." Case XIX, of five months, "covered with new connective tissue." Case XXIV, of seven weeks, "acetabulum entirely filled." Case XXV, seven weeks, "acetabulum nearly obliterated by granulation tissue."

In the author's case the cavity was covered by the anterior portion of the capsular ligament, and almost completely filled with a dense connective tissue new growth. The only exceptions to this rule are Case XIX, of one year, where the acetabulum is described as "empty," and Case XXIII, of eight weeks, where the acetabulum presented "relatively little alteration."

Closure and filling of the acetabulum with capsular ligament and new connective tissue must thus be looked upon as one of the chief causes interfering with the restoration of the head to its normal position, and this may occur as early as seven weeks (Case XXV) after the dislocation is produced.

Thirdly, may be mentioned a restoration or re-attachment of the ligamentum teres. Thus it is mentioned in Case VIII that "the round ligament preserved its normal connection with the head, and was adherent to the articular cartilage."

In Case XXIV, "the ligamentum teres, somewhat shorter and thicker than normal, extended from the old insertion point in the head of the femur to the bottom of the new fibrous joint capsule. The otherwise completely-movable head remained fast to this band after all the remaining fibres had been divided. This new-formed, vessel-containing, fibrous band was divided, and only then could the head be raised out."

In order to determine the length of time necessary for the acetabulum to become filled with new connective tissue, and also as to whether the round ligament may be restored, and acquire new attachments after dislocation, Volkmann¹ undertook some very interesting experiments on dogs and rabbits.

He would produce a dislocation of the hip in a dog or rabbit, and after a certain variable length of time, cut down upon it and examine the parts. He found that the granulation tissue, which filled the acetabulum, arose, on the one hand, from the remains of the round ligament at the bottom of the cavity, and, on the other hand, from the torn capsular ligament, and the many torn soft parts, which are now drawn over the acetabulum by the dislocated head.

This granulation tissue in the dog, on the twelfth day, is still very soft, and easily wiped out of the cavity, offering at this time no hinderance to reduction, for the soft granulations would be crushed in the cavity by the reduced head and absorption occur. After fourteen days in dogs, such a reduction is followed by complete *restitutio ad integrum*.

After three and a half weeks the new connective tissue was much firmer, and adhered everywhere to the cartilage; however, it could be stripped off this with some force, the cartilage itself remaining uninjured.

At the end of eight or ten weeks, on the contrary, a very

¹ Deutsche Zeitsch. f. Chir., Bd. xxxviii, p. 373.

hard fibrous mass filled the joint which in itself would make reposition impossible. It adhered inseparably to the bottom of the cavity. The cartilaginous covering of the latter, to which the connective tissue has grown fast, showed on microscopical sections its normal structure in most places, while in other places it was beginning to become fibrous, and show transitions from hard connective tissue to cartilage.

In regard to the round ligament, it was found that in new joints formed under favorable circumstances, it was often reproduced entirely, even after being separated close to the head, so that in fact the new-formed joint was extremely like the old one. This band could not be considered as the old ligament which had been separated close to the bottom of the cavity, and dislocated outward with the head, becoming attached again by its torn end. This was impossible, firstly, because in the experiments the band was divided close to the head, the greater part remaining in the cavity, and, secondly, because in animals one can follow the new growth of the band.

After twelve days the small remains of the ligamentum teres on the femoral head were found changed into a prominent granulating growth, which evidently has a tendency to attach itself to the likewise granulating inner surface of the new capsule. After twenty-three days the union was complete, a band of young connective tissue, which is always stretched and lengthened by the movements of walking, extended from the fossula capititis to the bottom of the new joint. This band, which at the end of three and a half weeks, was still soft and easily torn, became later very firm and tendinous, and in favorable cases, after ten or twelve weeks, was distinguishable only by its irregular form and false insertion from a normal ligament.

As the last, but not least, factor interfering with reduction may be mentioned the shortening of all the muscles and tendons inserted into the upper end of the femur, and the adhesions or new capsule formed about the head. This shortening is simply the usual contraction which all tissues in the body undergo when abnormally relaxed, and in old cases is one of the most important elements in preventing reduction.

After this review of the hinderances to reduction, it is easy to see why so many of the earlier operators failed. Out of twenty attempts to reduce with the joint freely opened, eleven, or 55 per cent., were unsuccessful and ended by making a resection.

This was owing to the fact that when they found the acetabulum filled no attempt was made to excavate it; when it was impossible to bring the head down to the level of the acetabulum owing to the shortening of the pericotyloid muscles they resected the head, thus shortening the neck and accommodating it to the shortened condition of the surrounding soft parts. In so far as the results of resection are concerned they can, on the whole, only be classified as fair. The mortality was *nil*. The amount of shortening of the leg in Case XXIII, none; Case V, two and a half centimetres; Case XVI, three to four centimetres; Cases III, XV, XVIII, four centimetres; Case XXI, five centimetres; while in Cases I, IV, VIII, X, XI, and XII, the amount is not stated. As regards motion, Case V could run, jump, play cricket, and ride a tricycle; Case VIII, movements free in all directions; Case III, could not raise the leg from table when lying down, passive motion slight, walked with cane, marked limp; Case XV, some motion in hip, walked with aid of cane and high shoe; Case XVIII had some active motion; Case XXIII could execute all movements to a limited extent; Case I, simply stated patient had a useful limb; Cases IV and X result simply stated as being good; Cases XVI and XXI had stiff hips; and in Cases XI and XII, results are not stated.

Coming now to the fourth of our classification of operations, or arthrotomy with reduction, we find nine cases, Nos. IX, XIII, XIV, XVII, XIX, XXII, XXIV, XXV, and XXVI. Of these, Case IX, an old alcoholic, died in four days from foudroyant gangrene; in XIII and XIV, details are lacking and the results are not stated; Case XXV had a spontaneous recurrence of the dislocation soon after leaving the hospital. He had talipes equinus and inversion of the foot with partial paralysis of the anterior tibial group. When he left the hospital, less than two months after the operation, he had good motion in the hip and could walk with the aid of a cane. In the remaining five cases,

XVII, XIX, XXII, XXIV XXVI, reduction being accomplished, there was no shortening or deformity in any of them. They all recovered with movable joints.

Case XVII, at the end of eleven weeks was walking around with the aid of a cane and crutch, without pain, the range of motion limited, but continually increasing. He left the hospital then and was lost sight of. Case XIX was discharged at the end of fourteen weeks, being able to walk without crutches, position of the leg normal, motion fair and daily improving. Case XXII could walk without support in four weeks. Motion was only in extreme execution slightly hindered. At the end of two years no abnormality could be detected. Result perfect.

Case XXV, nine months after operation he was on his feet the whole day without fatigue, could walk hours at a time, and could jump and run without difficulty. Motion as free and extensive as the other side. Case XXVI, four months after the operation walked without support, no pain in hip, good, active motion in all directions which was daily increasing in extent.

A consideration of these results shows, as might have been *a priori* expected, that the operation of arthrotomy with reduction has given much the best results.

That the operation is not an easy one the many failures attest, but as these failures were due, first, to unfamiliarity with the causes preventing reduction, thus leading to second, unfavorable incisions and methods of approaching the joint, and third, to lack of thoroughness: it is to be expected that they will be less common in the future. In most of the failures the incision was made directly over the dislocated head of the bone, thus bringing the head and neck between the operator and the acetabulum, making it impossible to reach and excavate the cavity until the head was removed.

Nicoladoni (*loc. cit.*) was the first to recognize the importance of a properly-placed incision, and recommended that it be placed anteriorly in posterior dislocations and posteriorly in anterior dislocations.

A better rule, and the one here advised, is to place the incision where it will lead directly to the acetabulum, and at the same

time permit easy access to the trochanter major. This, in the great majority of the cases will be found to be in front, as in the author's case, along the posterior border of the tensor vaginæ femoris, between it and the gluteus medius. This leads directly to the acetabulum, and the head, neck, and great trochanter can be easily reached and denuded.

A single straight incision is all that is necessary, and the Y- and T-shaped incisions, as in Cases IV and VIII, are not to be recommended. The head and neck are then to be denuded, together with a division of all the muscular attachments into the great trochanter and shaft as far down as the lesser trochanter. The muscular attachments are better separated subperiosteally as much as possible so that when they regain their attachments there will be less derangement. This denudation must be thorough, so that the entire upper end of the femur is perfectly free, otherwise it will be impossible to bring the head of the bone opposite the acetabulum, owing to the contraction of the soft parts.

The very close proximity of the great sciatic nerve to the head in posterior dislocations should not be forgotten.

After freeing the upper end of the femur, the acetabulum, if filled, should be excavated with a sharp spoon or gouge and mallet. No pains should be spared in the use of the gouge to enlarge the cavity sufficiently to permit the easy entrance of the head. The head is then returned to the acetabulum, the wound closed, extension applied, and the limb immobilized in a slightly abducted position.

Owing to the tendency of the dislocation to recur, as shown in Cases XXIV and XXV, the extension and immobilization should not be discontinued too early, perhaps not under four weeks in old cases.

In closing I would present the following conclusion:

(1) That owing to the danger of fracturing the neck of the femur,¹ laceration of the great vessels of the thigh,² and shock,³ and death (*loc. cit.*), the application of great force to reduce old

¹ Archiv f. klin. Chir., 1885, No. 32, p. 440.

² ANNALS OF SURGERY, June, 1892, p. 425.

³ Rev. d'Orthop., September, 1890.

dislocations of the hip should be discontinued in favor of arthrotomy.

(2) That subcutaneous operations in old dislocations are without benefit.

(3) That osteotomy below the trochanter could scarcely come into consideration at this day.

(4) That resection is only to be thought of when reduction by arthrotomy fails; and, finally,

(5) That the operation which has given the best results is free arthrotomy with reduction after the method here described.

CASES OF OPERATIVE REDUCTION OF OLD HIP-JOINT DISLOCATION.

Case No.	Operator.	Date.	Age.	Variety.	Duration.	Operation.	Incision.	State of Acetabulum.	Results.
I.	Delagarde.	Sept. 1, 1866.	51 years.	Sciatic.	6 months.	Resection of head.	From trochanter to sacrum.	Not stated.	Had a serviceable limb. Amount of shortening and range of motion not stated. Failure; could not reduce; tenotomy of no benefit.
II.	Hamilton.	Feb. 24, 1869.	28 years.	Dorsal.	8 months.	Subcutaneous division of ilio-femoral ligament and tensor vaginae femoris muscle. Arthrotoxy; failure to reduce followed by resection below trochanter.	• • • •	Covered by a musculo-fibrous layer.	Nine months after operation 4 cms. shortening; slight active motion, but cannot raise leg from table; walks with cane; moderate limp. Said to have been good, but no details given.
III.	Volkmann.	May, 1876.	51 years.	Perineal converted into dorsal.	3½ months.	Straight over trochanter with transverse cut of muscles.	• • • •	Five years after operation 1 inch shortening; good use of limb; can run, jump, play cricket, and ride a tricycle.	
IV.	MacCormac.	1878.	Adult.	Thyroid.	20 months.	Subcutaneous tenotomy without benefit, followed by resection of head. Resection of head.	Y-shaped over trochanter.	Not stated.	Not good; great shortening and marked deformity.
V.	Sidney Jones.	Nov. 25, 1879.	II years.	Dorsal.	7 months.	Resection of head.	• • • •	Filled with condensed cellular tissue and inflammatory material.	Useful limb, with few centimetres shortening.
VI.	Koch.	Oct. 3, 1881.	41 years.	Sciatic.	20 months.	Osteotomy just above trochanter minor.	• • • •	Seven months after operation limb straight and motion free in all directions; amount of shortening not stated.	Seven months after operation limb straight and motion free in all directions; amount of shortening not stated.
VII.	Wahl.	Feb. 16, 1882.	...	Dorsal.	25 days.	Osteotomy below trochanter major.	• • • •	Arthrotoxy with reduction.	Death from acute gangrene in 4 days; old alcoholic.
VIII.	Wm. Adams.	Mch. 29, 1882.	11 years.	Dorsal.	More than a month.	Subcutaneous tenotomy of adductor longus; no benefit; followed by resection of head.	T-shaped over head and neck.	Anterior.	...
IX.	Polaillon.	1883.	46 years.	Obturator.	1½ months.	Arthrotoxy with reduction.	• • • •

CASES OF OPERATIVE REDUCTION OF OLD HIP-JOINT DISLOCATION—CONTINUED.

Case No.	Operator.	Date.	Age.	Variety.	Duration.	Operation.	Incision.	State of Acetabulum.	Results.
X.	Margury.	1884.	...	Dorsal.	8 months.	Arthrotomy; failure to reduce; followed by resection of head.	Said to have been good, but details lacking.
XI.	Nicoladoni.	1885.	...	Dorsal.	76 days.	Arthrotomy; failure to reduce followed by resection below trochanter.	Usual incision for resection.	...	Case suppurated and result not stated.
XII.	Severano.	Oct., 1886.	Adult.	Dorsal.	4 days.	Arthrotomy; failure to reduce followed by resection of head.	Over head parallel to fibres of gluteus maximus.	...	Not known; left hospital at end of 30 days, with wound healed; never heard of thereafter.
XIII.	Vecelli.	1887.	...	Dorsal.	...	Arthrotomy with reduction.	Anterior.	...	Not stated.
XIV.	Vecelli.	1887.	...	Anterior.	...	Arthrotomy with reduction.	Anterior.	...	Not stated.
XV.	Quénau.	Sept. 28, 1887.	26 years.	Dorsal.	2½ months.	Arthrotomy; failure to reduce followed by resection of head.	Posterior, over head of femur.	“No sign whatever of acetabulum.”	Five months after operation 4 cms. shortening; motion in hip; can flex to a right angle; walks with aid of cane.
XVI.	Bloch.	Dec. 23, 1887.	17 years.	Dorsal.	120 days.	Arthrotomy; failure to reduce followed by resection of head.	Anterior between sartorius and rectus, followed by Langenbeck incision for resection.	“Completely filled with solid matter.”	Eleven months after operation 3 to 4 cms. shortening; has some motion at hip; can walk without cane, but needs one for long distances.
XVII.	Parkes.	May 12, 1888.	21 years.	Dorsal.	1 year.	Arthrotomy with reduction.	Posterior, over head and neck.	“Empty.”	Eleven weeks after operation left hospital with limb in good position; motion constantly increasing; able to walk with cane and crutch.
XVIII.	Ricard.	Aug. 2, 1889.	Adult.	Ischiatic.	8 months.	Resection of head; neck placed in acetabulum.	Posterior, over head.	“Contracted and deformed.”	Some months later 4 cms. shortening; new joint formed; can execute movements of flexion, adduction, and slight abduction.

CASES OF OPERATIVE REDUCTION OF OLD HIP-JOINT DISLOCATION—CONCLUDED.

Case No.	Operator.	Date.	Age.	Variety.	Duration.	Operation.	Incision.	State of Acetabulum.	Results.
XIX.	Parkes.	June 6, 1890.	30 years.	Backward.	5 months.	Arthroscopy with reduction.	Posterior, with extension forward from middle.	"Covered with connective tissue."	Fourteen weeks after operation limb normal in position; motion fair and daily improving.
XX.	Villeneuve.	Dec. 1, 1890.	48 years.	Subpubic.	2 months.	Arthroscopy; failure to reduce followed by osteotomy lower half of trochanter.	Anterior.	Covered by thick layer; could not feel cavity.	Fifteen months after operation 4 cms. shortening; motion slight at hip; walks with cane; limp after walking 15 minutes and has pain.
XXI.	Hughes.	Dec. 5, 1890.	11 years.	Suprapubic.	2½ months.	Arthroscopy; failure to reduce followed by resection of head.	Anterior, over neck of femur.	• • • •	Seven months after operation 2 inches shortening; hip stiff; can walk with high shoe.
XXII.	Helferich.	May 18, 1891.	4 years.	Dorsal.	18 days.	Arthroscopy with reduction.	Anterior between sartorius and tensor vaginæ femoris.	Normal and empty.	Perfect; after two years no abnormality could be detected.
XXIII.	Tillaux.	June 9, 1892.	50 years.	Perineal.	8 weeks.	Resection of head; neck placed in acetabulum.	Behind tendon of adductor major over head.	"Relatively little alteration."	No shortening; after 3½ months motion good; walks without support.
XXIV.	Küster.	Sept. 23, 1892.	9 years.	Dorsal.	7 weeks.	Arthroscopy with reduction.	Straight over trochanter (Langenbeck's).	"Entirely filled with connective tissue."	Perfect; 9 months after operation motion as free, smooth, and extensive as other leg.
XXV.	Gerster.	Dec. 20, 1892.	8 years.	Dorsal.	7 weeks.	Arthroscopy with reduction.	Straight over trochanter (Langenbeck's).	"Almost obliterated by granulation tissue."	Had paralysis in anterior tibial muscles with talipes; result was good until patient left hospital, when dislocation recurred some 2 months after operation.
XXVI.	Harris.	Feb. II, 1894.	33 years.	Dorsal.	4 months.	Arthroscopy with reduction.	Anterior between tensor vaginæ femoris and gluteus medium.	Covered by capsular ligament and filled with connective tissue.	Four months after operation position normal; no shortening; active motion in all directions limited, but daily increasing; walks without support; no pain.